

Development of C++ Application Program for Solving Quadratic Equation in Elementary School in Nigeria

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Abstract

The study was conducted to design, develop and test a c++ application program CAP-QUAD for solving quadratic equation in elementary school in Nigeria. The package was developed in c++ using object-oriented programming language, other computer program that were also utilized during the development process is Dev-C++ compiler, it was used for compile, run and debug the program. The descriptive research design of survey type was adopted specifically, the one group post-test design, it was simple random sampling technique. The CAP-QUAD package was tested on 20 students from Ola-oluwa Muslim Grammar School Ado-Ekiti, Ekiti State, Nigeria on individual learning which formed the sampled of the study. Two set of instruments were use to collect data for the study, they are Quadratic Equation Assessment Test (QAT) and researcher-developed Questionnaire. The two instruments were subjected to face and content validity by test and measurement expert. The reliability coefficient for QAT using kuder-richardson was 0.78. The test re-test method of reliability was used to determine the reliability coefficient of the Questionnaire which stood at 0.81. The data were analysed using mean and percentage scores. The study revealed the performance level of students when exposed to use CAP-QUAD is very high which is excellent. The result further showed that students opinion and impression concern the package is positive while most of the students prefer to use the package and suggest to friends to used. In view of the implication of findings, it was recommend that research into the design and development of computer educational packages and utilization into the classroom should be encourage, while computer package like MATLAB and others should providing in all other subject.

Keywords: Application program, Quadratic Equation, Elementary School, Development

INTRODUCTION

Technology has tremendous potential for enhancing mathematics instruction; it can be used to strengthen student learning and to assist in developing mathematics concepts. Technology can enrich student learning in the areas of richer curricula, enhanced pedagogical and more effective organization structures (Dede, 2000).

In the past, students learned by traditional teaching method infused with the current technology and the new teaching method of the time. As innovations in teaching have been developed, teachers have integrated these innovations into their classrooms. Whereas calculator or graphing software have been used in higher-level math classes for decades, computer teaching tools are relatively new in remedial math is class.

It has been noted that “evidence is mounting to support technology advocate ‘claim that 21st century information and communication tools, as well as more traditional computer-assisted instruction application; can positively influence student learning process and outcome” (Cadler, McNabb, Freeman, & Burchett, 2002 p.47). Svensson (2000), a Swedish educator who has conducted a great deal of research into the ability of computers to influence learning in schools, suggested that computer can influences learning in schools and lead educational practices toward more student-active learning, thus allowing students the ability to develop strategies for learning through interaction.

Money spent on computers in public schools has increased at a steady rate over the last 20 years. Even with this increase in computers in the classroom, most instruction utilizes technology for its own sake, without authentic integration into school subjects, and is primarily focused on drill and practice instruction (Hopper and Hokanson, 2000). With this increase in expenditures on computers, there is remarkable potential for the effective integration of computers in school mathematics.

More advanced technology tools in mathematics take the form of computer applications, calculators, and language (e.g Logo; Connell, 1998). There are a number of potential benefits of using the computer as a tool for instruction in an educational setting. First, technological tools help to support cognitive process by reducing the memory load of a student and by encouraging awareness of the problem-solving process. Second tools can share the cognitive load by reducing the time that students spend on computation.

Third, the tools allows student to engage in mathematics that would otherwise be out of reach, thereby stretching students’ opportunities. Fourth, tools support logical reasoning and hypothesis testing by allowing students to test conjectures easily (Lajoie, 1993). Instructionally, computer allows for a record of problem-

solving process- the fits, start, and different pathways children follow- be recording and replaying as a window into children's thinking.

In Nigeria educational system, ICT has helped to increase access to and improving the relevance and the quality of education. It greatly facilitates the acquisition and absorption of knowledge, offering developing countries unprecedented opportunities to enhance educational systems improve policy formulation and execution and widen the range of opportunity for business and the poor. It has assisted in improving the quality of education and training by increasing learners' motivation and engagement, facilitating the acquisition of basic skills. The use of ICT tools such as videos, television and multimedia computer software that combine text, sound and colourful moving images is used to provide challenging the authentic content that engages the students to be more involved.

It was the purpose of this study; therefore the application software or computer tools are used for reinforcement of previously learned topic, is simply used to present a variety of exercises in a specific area of mathematics in rapid succession, with minimal feedback. In general, no new conceptual topic is introduced. With this type of software, "material or topic (questions) is input by the user, and the user has to operate under the control of the program, undertaking tasks within highly directed formats. These is usually designed to be used in isolation of the teacher, but may be used with peers or groups of students who ask for assistance from peers or the teacher when the error occur.

The Advantage of the Application Software:

Immediate Feedback

The difference between pen and paper, and the software is that when students use pen and papers he or she may do their work, sometimes wrong and that issue that arise is that, they will believe what is wrong is correct and may retain the information until it is corrected by the teacher. However, the software allows the student's to know immediately if the problem is accurate or not.

Motivation

Students may get fed up doing practice exercise in paper, or do not like writing a lot, because of this using computer may be a motivation to them to practice what they need.

Saving Teachers Time

Teachers are better able to manage their time, in the sense that student practice on their own while the teacher can work or address other student needs in the classroom.

Learn at your own Space

It assists the students' to master their work at their own space.

Keeping in view of all these aspects, the study was conducted with the following specific objective.

1. To design and develop a C++ application program for solving Quadratic Equation (CAP-QUAD) in elementary schools.
2. To test the effectiveness of the developed CAP-QUAD in terms of: performance level of students in Quadratic Equation when used CAP-QUAD in solving and to know their level of satisfaction.

METHODOLOGY

Development of C++ Application Program for Quadratic Equation (CAP-QUAD)

The CAP-QUAD package was written in C++ using object-oriented programming language. Other computer program and application that were also utilized during the development process is Dev-c++ compiler. The Dev-c++ compiler was to compile, run and debug the program. The programs is been written in modules, the first modules deals with the input of data, computation and display on the screen, the input of data concerning the value of the quadratic equation of $ax^2 + bx + c = 0$, while the second module is the control structure were it permit the user to solve another question without exist from the screen based on the choices of the user either Yes or No. Figure 1: presents a partial window view of the software.

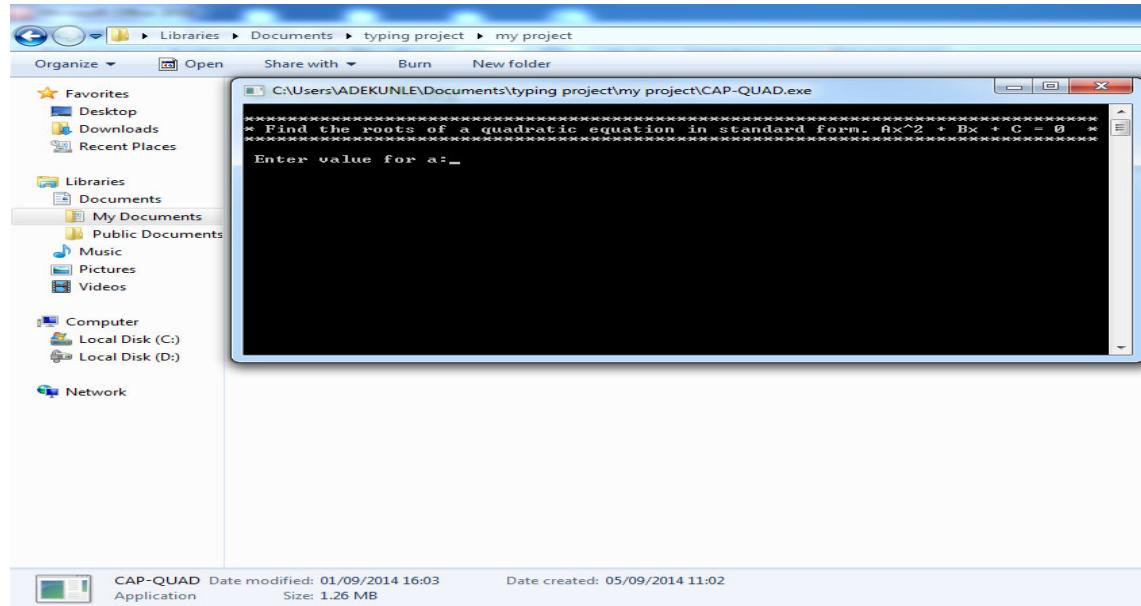


Figure: A partial window view of the software

Run of Software

The developed software was copied to the classroom computers and the individual student was asked to appear for the test in presence of an invigilator other than the instructor of the class. A sample of a run of the software is presented in this section. As an example presented here is figure: 2 which shows the working template of the program.

```

C:\Users\ADEKUNLE\Documents\typing project\my project\CAP-QUAD.exe

*****
* Find the roots of a quadratic equation in standard form. Ax^2 + Bx + C = 0 *
*****

Enter value for a:1
Enter value for b:5
Enter value for c:6
Root are Real
x1 = -2
x2 = -3

Would you like to solve another?
Enter 'y' for 'Yes' -- 'n' for 'No', y

Enter value for a:5
Enter value for b:-5
Enter value for c:-2
Root are Real
x1 = 1.30623
x2 = -0.306226

Would you like to solve another?
Enter 'y' for 'Yes' -- 'n' for 'No',

```

Figure: Working template of the program

The packages run by click on the executable file of the program. It displays the computation menu. The prompt options are:

Enter value for a:

Enter value for b:

Enter value for c:

All this prompt option are required by the student to input the necessary values which must be the value of quadratic equation $ax^2 + bx + c = 0$. After this, input values the program does all the logical and mathematical needed by the package.

This however does not take more than ten (10) seconds at most, when the computation finished, it displays the result of the computation. After that, it prompts the student "would you like to solve another enter 'Y' for yes.....'N' for no ", depending on the choice made by the student, if is yes student perform another computation one at a time until student choose 'No' and the program closed.

The execution of the program generate the result output is partially demonstrated in figure 3. Figure 3, show below are the result generated based on the quadratic equation examples given which are:

1. $x^2 + 5x + 6 = 0$

2. $5x^2 - 5x - 2 = 0$
3. $x^2 + 10x + 25 = 0$

```
*****
* Find the roots of a quadratic equation in standard form. Ax^2 + Bx + C = 0 *
*****

Enter value for a:1
Enter value for b:5
Enter value for c:6
Root are Real
x1= -2
x2= -3

Would you like to solve another?
Enter 'y' for 'Yes' -- 'n' for 'No' y

Enter value for a:5
Enter value for b:-5
Enter value for c:-2
Root are Real
x1= 1.30623
x2= -0.306226

Would you like to solve another?
Enter 'y' for 'Yes' -- 'n' for 'No' y

Enter value for a:1
Enter value for b:10
Enter value for c:25
Root are Equal!
x= -5

Would you like to solve another?
Enter 'y' for 'Yes' -- 'n' for 'No' y
```

Figure 3: Result generate on the quadratic equation examples

Field Testing

The research procedure adopted for the study is descriptive design of the survey type; specifically the one group post test design, it was simple random sampling technique. The CAP- QAUD package was tested on 20 students from Ola-oluwa Muslim Grammar School Ado- Ekiti, Ekiti State, Nigeria on individual learning. The school was simple sampled based on ICT equipment (computer laboratories with well equip computers), school type (public school) and exposure (student and teachers exposure to the use of computer in their school).

Instrumentation

Two set of instruments were use for the study, the first was tagged Quadratic Equation Assessment Test (QAT) which was design by the researcher. QAT consisted of 25-multiple choice objectives items adopted from New General Mathematics for Senior Secondary School Two (2). The second instrument use for the field testing of the package was a researcher- developed Questionnaire. All the items in instrument were constructed to elicit response from students with respect to the use of the package. The Questionnaire consist of two section with section A sought information on the opinion and impression concern the package, and section B sought information on the student preference toward the use of the package compared to normal method of solving (paper and pen). Respondent were to indicate whether they strongly agree, agree, disagree or strongly disagree with the question asked by ticking their own opinion using 4-point likert scale.

Validation

The two instruments were subjected to face and content validity by test and measurement experts. Based on their corrections and suggestions irrelevant items were deleted.

Reliability

The package was trial tested on sample representative similar to the student used for the final study. The QAT and Questionnaire was trial administered on them. The reliability coefficient of QAT was computed using Kuder-Richardson. The reliability coefficient was 0.78. The reliability of Questionnaire was determines using test re-test method, the scores obtained were analysed using person product moment correlation coefficient and the reliability coefficient was 0.81 respectively.

Data scoring and Analysis

The scores in Quadratic Equation Assessment Test (QAT) were collated and was analysed using the mean and percentage. The duly completed copies of the Questionnaire were collected and for analysis using percentage scores.

RESULT

Table 1: Performance level of students when exposed to used CAP-QUAD

S/No	Scores/25	
Percentage		
1	20	80
2	21	84
3	20	80
4	19	76
5	18	72
6	20	80
7	21	84
8	22	88
9	20	80
10	24	96
11	23	92
12	19	76
13	17	68
14	22	88
15	24	96
16	23	92
17	18	72
18	20	80
19	23	92
20	20	80
MEAN		20.7
82.8		
SCORES		

Result in table 1 showed the average or mean scores of the students out of a maximum scores of 25 is 20.7. This translates to 82.8%, to make a conclusion about the performance level of students in Quadratic equation when exposed to use the CAP-QUAD package. The interpretation of the result was based on the following grading which is commonly used in Nigeria Secondary Schools.

Below 40% = Very poor

41% - 49% = Poor

50% - 59% = Good

60% - 69% = Very good

70% - 100% = Excellent

Since the mean percentage score of the student is 82.8%. The conclusion therefore is that when students were exposed to use CAP-QUAD package in solving Quadratic equation, their performance level was excellent.

Table 2: Student's impression and opinion concern the package

Response

S/No	SA	A	D	SD	Statement			
1.	The message in the package are clear to me and easy to understand			10	9	1	0	
2.	The package permit me to repeat another calculation without exit from the screen			18	2	0	0	
3.	The package enable me to repeat what I have learnt in class repeatedly			10	6	2	2	
4.	This package provide immediate feedback to me after enter the appropriate value			18	1	1	0	
5.	This package display comment when enter wrong question and prompt me to verify the question correctly			10	10	0	0	
		Total		66	28	4	2	

From table 2, the overall total students response to the items = $66 + 28 + 4 + 2 = 100$

Total response (strongly agree) = 66

Percentage response (strongly agree) = $(66 \div 100) \times 100 = 66\%$

Total response (Agree) = 28

Percentage response (Agree) = $(28 \div 100) \times 100 = 28\%$

Total response (Disagree) = 4

Percentage response (Disagree) = $(4 \div 100) \times 100 = 4\%$

Total response (Strongly disagree) = 2

Percentage response (Strongly disagree) = $(2 \div 100) \times 100 = 2\%$

Total positive response (Strongly agree and agree) = $66 + 28 = 94$

Percentage positive response (Strongly agree and agree) = $(94 \div 100) \times 100 = 94\%$

Total negative response (Disagree and strongly disagree) = $4 + 2 = 6$

Percentage negative response = $(6 \div 100) \times 100 = 6\%$

Table 2, shows that ninety seven percent (94%) of the students agreed that the instructional package CAP- QUAD was suitable for the learning of quadratic equation. Students impression and opinion on the package is that, it permit them to repeat another calculation without exit from the screen, allowed them to repeat what they have learnt in class and also the messages in the package are clear to them and easy to understand.

However, three percent (6%) disagree with some of the statements on the impression and opinion concern the package.

Table 3: Student's preference toward the used of the package

<i>Response</i>					Statement
S/No	SA	A	D	SD	
1.	I prefer solving quadratic equation with this package and the teacher acting as a facilitator	8	10	2	0
2.	Solving quadratic equation with this package is more preferable than using paper and pen	12	8	0	0
3.	I will suggest to my friend to use this computer package in solving mathematics question	12	7	1	0
4.	Using the computer package held my attention and allow me to practice more than I thought	7	10	2	1
<i>Total</i>		39	35	5	1

From table 3, the overall total students response to the statement = $39 + 35 + 5 + 1 = 80$

Total response (strongly agree) = 39

Percentage response (strongly agree) = $(39 \div 80) \times 100 = 48.75\%$

Total response (Agree) = 35

Percentage response (Agree) = $(35 \div 80) \times 100 = 43.75\%$

Total response (Disagree) = 5

Percentage response (Disagree) = $(5 \div 80) \times 100 = 6.25\%$

Total response (Strongly agree) = 1

Percentage response (Strongly agree) = $(1 \div 80) \times 100 = 1.25\%$

Total positive response (Strongly agree and agree) = $39 + 35 = 74$

Percentage positive response (Strongly agree and agree) = $(74 \div 80) \times 100 = 92.5\%$

Total negative response (Disagree and strongly disagree) = $5 + 1 = 6$

Percentage of negative response (Disagree and strongly disagree) = $(6 \div 80) \times 100 = 7.5\%$

The table 3 above shows that ninety six percent (92.5%) of students prefer to solve quadratic equation with the package than using the paper and pen method. Most of them were also willing to suggest the use of the package to solve equation to friends. The table above show that students say the package held their attention and it will allow them to practice more while, few of them (7.5%) held contrary opinion.

Discussion

The findings earlier shows that 94% of the students agree that instructional package (CAP-QUAD) were suitable for the learning of quadratic equation. Students opinion on the package are the messages in the package are clear and easy to understand to them, the package permit them to repeat another calculation without exit from the screen, the package enable them to repeat what they have learnt in class, this package provide immediate feedback to them when enter the appropriate values, also usually display comments when enter wrong question and prompt them to verify the question correctly.

While, 6% of the students disagree with some of the statement items based on their opinion concern

the package.

The result obtained from the student preference toward the used of the package (CAP-QUAD) compared to manual way of solving equation. 92% of the respondents agree to the preference of the package in respects that they prefer solving quadratic equation with the package and the teacher acting as a facilitator, also the package is more preferable to than using paper and pen, the manual way of solving equations.

Most of the students were willing to suggest the use of the package to friends for solving quadratic equation and the package held their attention because it allows them to practice more than they thought.

The performance of students in QAT suggest a high degree of validity of the package, it could be deduced that when students were exposed to used the package in solving quadratic equation it obtained high mean scores. These suggest that computer application package could be more-effective in cooperative and individual learning. Though, this study is limited to the development of application program only, it did not mean to compare the effectiveness of student's performance.

The findings of this study agree with the finding of (Kahn, 1988-1999) that instructional software provides the following acknowledge benefits as compared to paper- exercises.

- a. Given immediate feedback, private feedback to students
- b. Motivates students to practice
- c. Saving teacher time while correcting student work
- d. Math fact

CONCLUSION

In order to implement the use of any type of instructional software, instructional technology and educational technology, teachers must feel confident in its operation and their own ability to integrate it into daily classroom practices.

The use of computer technology enhance teacher to student interaction, student to student interaction as well as it helps student to become more independent.

Computer technology, when properly used, can enhance learning and has the potential to positively influence students' success rates (Carter, 2004).

On the basis of the major findings of this study, it was conducted that the use of CAP-QUAD package is more positive and effective in improving students study skill and ability in mathematics problem solving.

Also, encourage or motivate the students to practices more than they thought and improve the proficiency in computer use which will be valuable later in life.

RECOMMENDATIONS

Based on the findings and conclusion of the study, the researchers recommend as follows.

Research into the design and development of computer instructional packages and their utilization for classroom instruction should be encouraged. This could be achieved if education stakeholders can support the schools with ICT infrastructure (computer with internets facilities, LCD projectors, and interactive white board e.t.c), manpower, computer software packages, electricity supply and many others.

The government should as a matter of commitment equip their schools with computer facilities, provide necessary educational software to aid effective teaching and learning in the schools.

The computer instructional packages such as MATLAB, Algebrator e.t.c should be provide in all other science subject.

Science teacher should be trained how to use educational software effectively in the classroom.

Computer programs should be chosen based on pedagogical and philosophical underpinnings as well as for usefulness in achieving desired levels of Bloom's Taxonomy of Learning.

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